Tooth Loss Patterns in Hypertensive Patients with Chronic Periodontitis

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Authors' contributions

This work was carried out in collaboration among all authors. Author VR designed the study, performed the statistical analysis, wrote the protocol and wrote the first draft manuscript. Authors MJ and SJ managed the analyses of the study. Author MJ managed the analyses of the study. All authors read and approved the final manuscript.

Original Research Article

ABSTRACT

Aim: The aim of the study is to study the tooth loss pattern in patients with chronic periodontitis and hypertension.
Study Design: Retrospective cohort study.
Materials and Methods: The case sheet records (DIAS data) of tooth loss pattern in hypertensive patients with chronic periodontitis were extracted. A total of 1318 case sheets were analysed for the study. Age, gender and tooth loss pattern with respect to the region were collected and statistically analysed. Descriptive statistics (Percentage, Mean, Standard deviation) and Inferential test (Chi- square test) were performed to determine the association between age, gender and tooth loss pattern in patients with chronic periodontitis and hypertension.
Results: The results showed that that females were affected more with tooth loss with hypertension with chronic periodontitis when compared to males. According to age, patients between 50 to 70 years with chronic periodontitis and hypertension were more affected by tooth loss (p value = 0.001 ($p<0.05$; Statistically significant)).

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Conclusion: The present study highlighted a possible relationship between hypertension and tooth loss due to chronic periodontitis. Loss of mandibular posterior teeth were more common and females were more prone to tooth loss than males with hypertension due to chronic periodontitis. However, the underlying mechanism has to be further investigated in a different study design, thus more conclusive findings would be elucidated.

1. INTRODUCTION

A beautiful smile is due to the harmonious relationship between the components of the oral cavity such as lips, teeth, and gingiva for all Individuals. Factors hindering this smile among the population is generally tooth loss. Tooth loss is a multifactorial process involving dental caries, periodontal disease, a variety of socio environmental factors, educational levels, access to care and insurance status and general health status.

Hypertension is a major global health disorder affecting about 972 million adults in 2000 and expected to increase to 1.56 billion by the year 2025 [1]. Meanwhile periodontal disease is a group of chronic inflammatory diseases involving soft tissues and bone surrounding the teeth, known as periodontium. It is characterized by inflammation of tooth supporting tissues caused by bacterial infection [2]. Gingivitis is a reversible condition manifested as redness, gum swelling and may progress to periodontitis if left untreated [3].

Hypertension and periodontitis share some common risk factors, such as increased age, smoking, stress and socioeconomic factors. These risk factors may confound the association of the two diseases [4].

Since periodontal diseases may contribute to endothelial dysfunction as a result of inflammation, it has been identified as a risk factor for hypertension [5]. Therefore, periodontitis is known to be an important risk factor for cardiovascular disease including stroke [6], peripheral artery disease [7] as well as coronary heart disease [8]. Our team has extensive knowledge and research experience that has translate into high quality publications [9–28]. This study aims to analyse the tooth loss pattern in hypertensive patients with chronic periodontitis.

2. MATERIALS AND METHODS

The study group included in the study were local population of Chennai, Tamil Nadu, India. The data comprising of demographic details and tooth loss pattern in hypertensive patients with chronic periodontitis were collected from the duration of June 2019 to April 2020. A total of 1318 case sheets were analysed. The samples were collected by simple random sampling method. Cross verification of data was done. FDI tooth numbering system was followed in this study. Periodontal assessment used a standardized protocol. Baseline data on full-mouth periodontal assessment was retrieved from the case records for all participants. The periodontal examination & diagnosis data of the patients which includes probing depth, clinical loss of attachment, furcation involvement and tooth mobility were analysed.

The inclusion criteria for the Periodontitis patients include moderate to severe periodontitis not >2 teeth missing in each quadrant; greater than or equal to 30% of periodontal sites with periodontal pocket depth greater than or equal to 4 mm; greater than or equal to 20% of periodontal sites with interproximal clinical attachment loss >2 mm; greater than or equal to 30% of sites showing bleeding on probing; tooth mobility and furcation involvement and radiographic evidence of bone loss visible in posterior vertical bitewing films. Exclusion criteria for periodontitis group were individuals who had undergone periodontal treatment in the last 6 months. Inclusion criteria for hypertension are values of systolic blood pressure (SBP) ≥ 140 mmHg or diastolic blood pressure (DBP) ≥ 90 mmHg, or; the use of antihypertensive medication.

Incomplete and censored data were excluded. The analysis was done using SPSS version 19. The dependent variables were the number of missing teeth. The independent variables were age and gender. The data was statistically analysed using the Chi- square test. The level of significance was set at 0.05.

3. RESULTS AND DISCUSSION

The result showed that the majority of the hypertensive patients with chronic periodontitis were with missing posterior teeth, in which mandibular first molars were most commonly followed by maxillary first molars and mandibular and maxillary second molars. The results indicated that female patients with hypertension and chronic periodontitis were affected more with tooth loss than males [Fig. 1]. And also, patients between the age group of 50 to 70 years old were affected more with tooth loss than other age groups [Fig. 2]. The comparison of age of the patients and gender of the patients with the number of missing teeth were statistically significant [$p<0.05$].

Previous studies have reported that the prevalence of chronic periodontitis with hypertension was 16% [29]. Another study found that 22% of patients were presented with moderate periodontal disease and 68% were presented with severe periodontal disease [30].

Previous literatures have reported that the prevalence of hypertension were 18.7% in absence of periodontitis, 35.1% in mild periodontitis, 32.3% in moderate periodontitis and 52.8% in severe periodontitis groups. This evidence indicates there is an association between hypertension and periodontitis [31]. A more severe periodontitis may develop in patients having a higher risk of hypertension. A moderate to severe periodontal disease (odds ratio: 1.22; 95% CI: 1.10–1.35) and severe periodontal disease (odds ratio: 1.49; 95% CI: 1.09–2.05) were associated with hypertension [32].

Recent evidence suggests a possible causal link between periodontitis and hypertension. Patients with periodontitis often present with higher arterial BP values and a 30% to 70% higher chance to also present with hypertension, especially when there is active gingival inflammation (i.e., with gingival bleeding). The etiological bacterial burden of chronic periodontitis has also been positively associated with blood pressure (BP) and prevalent hypertension.

Several mechanisms underlying the links between gingival diseases and hypertension have been proposed with dysbiotic sub-gingival microbiome triggering low-grade systemic inflammation and oxidative stress representing the main pathways. Periodontitis patients express not only increased local and systemic inflammatory markers, such as C-Reactive Protein, TNF (tumor necrosis factor)-α, neutrophilic enzymes, WBC and disparity in T-cell subtypes but also neutrophil dysfunction, which are all mechanisms resulting in vascular changes and endothelial dysfunction. The presence of periodontal pathogens has been linked to hypertension in epidemiological studies. Preclinical evidence originated by experimental animal models, including immunizations with *Porphyromonas gingivalis* lysate and lipopolysaccharide-endotoxin from other gram-negative bacteria, caused prolonged T-cell activation and elicited increased levels of CRP, TNF-α, and IL (interleukin)-1β, resulting in increased BP. Interaction between oral-gut microbiome can also contribute to amplification of inflammation and metabolic changes. Recent evidence implicates oral bacteria in the nitrate-nitrite-nitric oxide (NO) pathway and pathogenesis of hypertension, with high concentrations of nitrite-reductase bacteria increasing systemic NO and having an effect of lowering SBP.

Several studies have reported an association between tooth loss and hypertension [33,34]. Mustafa Al-Ahmad BE et al. in a cross-sectional study found that tooth loss is significantly associated with hypertension in postmenopausal women [35]. A study in Korean population found interaction between tooth loss and ischemic stroke [36]. In a short-term prospective cohort study, a significant association was found between the presence of periodontal disease and hypertension in Japanese university students. But, the risk of prehypertension was not associated with presence of periodontal disease [37]. A recent systematic review reported that the evidence suggesting that the treatment of inflammatory diseases like periodontitis could reduce blood pressure is inconclusive [38]. The authors opinioned that oral health assessment and management of periodontal disease could not only improve oral and overall health and quality of life but also be of relevance in the management of patients with hypertension [32]. A systematic review assessing evidence from Mendelian randomization and a randomized controlled trial of nonsurgical periodontal therapy reported a causal relationship between periodontitis and BP was observed. The authors suggested that this provides proof of concept for the development of clinical trials in a large cohor
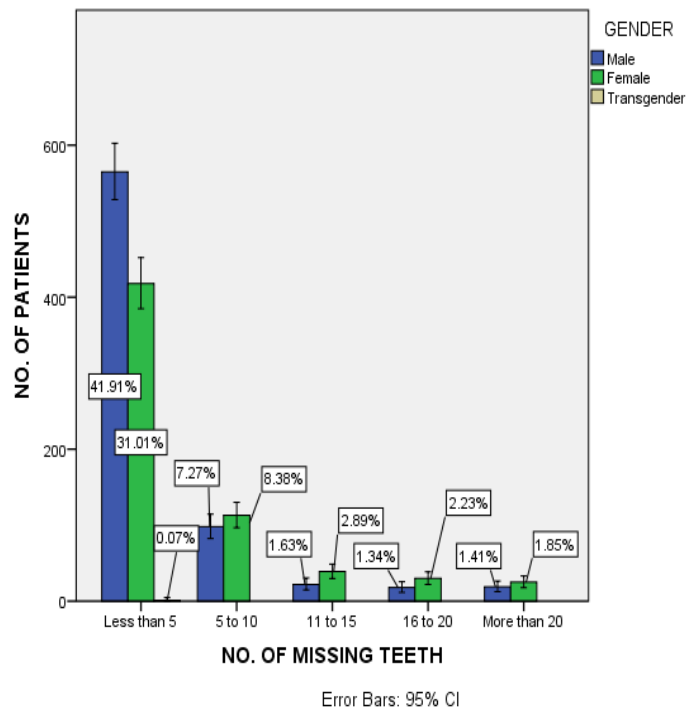
Fig. 1. The bar graph represents the comparison of gender of the patients and the number of missing teeth. The X- axis represents the number of missing teeth and the Y- axis represents the number of patients. The colour blue represents males, green colour represents females and yellow colour represents transgender
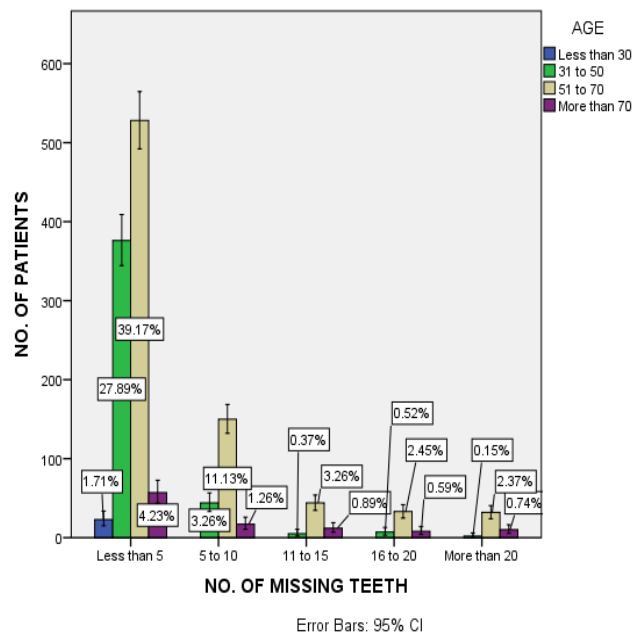

Fig. 2. The bar graph represents the comparison of age of the patients and the number of missing teeth. The X- axis represents the number of missing teeth and the Y- axis represents the number of patients. The colour blue represents the age group of less than 30 years old, Green colour represents the age group of 31 to 50 years old, Yellow colour represents the age group of 51 to 70 years old and the purple colour represents the age group of more than 70 years old

of hypertensive patients [39]. Several studies reported that hypertensive subjects exhibited a more detrimental periodontal status compared to control subjects [40,41,42].

The limitations of this study was small sample size and it is a single centered study. It does not represent all ethnic groups or populations. The future scope is to study a larger population and comparison among different ethnic groups. The study further aims at creating awareness and special preventive therapeutic measures for hypertensive patients.

4. CONCLUSION

The present study highlighted a possible relationship between hypertension and periodontal status. Within the limitations of the study it was seen that mandibular posterior teeth were most commonly missing followed by maxillary posterior teeth. It was also seen that the females were more prone to tooth loss than males with hypertension and chronic periodontitis. However, the underlying mechanism has to be further investigated in a different study design, thus more conclusive findings would be elucidated.

CONSENT

It is not applicable.

ETHICAL APPROVAL

As per international standard or university standard written ethical approval has been collected and preserved by the author(s).

ACKNOWLEDGEMENT

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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Peer-review history:
The peer review history for this paper can be accessed here:
https://www.sdiarticle5.com/review-history/78097